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Marshall Space Flight Center



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Vibration Testing and Analysis Using Holography

The use of holographic interferometry (holography) for analyzing the response of thin metal panels and cylinders subjected to steady-state vibrational and transient shock excitations has been investigated.

Time-average holography was used to study the mode patterns of the vibrating panels under steady-state conditions. To measure phase relationships under these conditions, real-time holography was used in conjunction with special phase-shifting techniques. Transient phenomena were studied by a method involving high-speed photography of real-time holographic interference patterns (holograms).

Time-average holography was found to be a useful method of recording steady-state vibrational mode patterns. Vibration amplitudes determined from the holographic data were verified by the data taken with a Michelson interferometer in separate measurements.

Two phase-measurement techniques were included. One used a phase-shifted reference beam which allowed the operator to control the apparent nodal position and thereby determine the phase at that position. The other used a strobe to "freeze" the observed real-time interference fringes. By varying the phase of the strobe light going to the panel, the operator could measure relative phases on the vibrating panel.

Transient response analysis with the aid of a high-speed motion picture camera did not yield

positive results. A high-speed movie of the real-time fringe system showed the result of hitting a cylinder with a small steel ball. It was concluded that analyzing the vibrational modes of cylinders is too difficult for practical use. A similar test was conducted on a small circular plate and was extended to include studies of the transient response to the removal of a steady-state forcing function, a step-function impulse, and a shock impulse. Only qualitative information could be obtained from these experiments.

Note:

The following documentation may be obtained from:

National Technical Information Service
Springfield, Virginia 22151
Single document price \$3.00
(or microfiche \$0.95)

Reference:

NASA-CR-103053 (N71-18982), Vibration, Flutter, and Transient Analysis Using Holographic Methods

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